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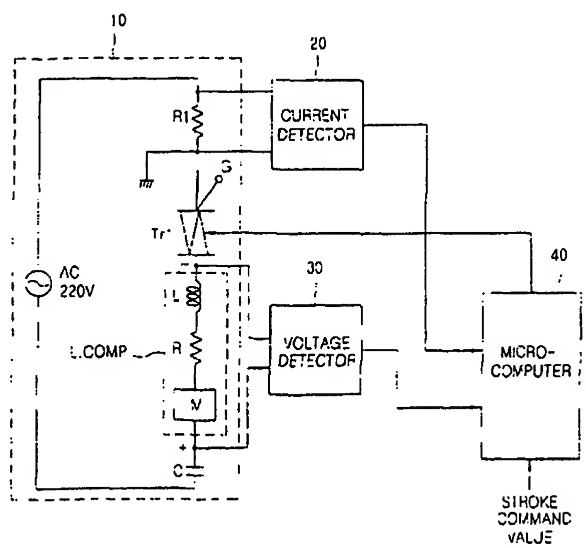
(54) Title: DRIVING CONTROLLING APPARATUS FOR RECIPROCATING COMPRESSOR



(57) Abstract: A driving controlling apparatus for reciprocating compressor using resonance, uses resonance increased in the current corresponding characteristic by compensating the inductance value of a coil turned inner part of the motor using a capacitor. A electric circuit further comprises a capacitor for compensating the inductance of the coil which is wound around the motor of the reciprocating compressing unit, accordingly, the burden of the applied voltage against the inductance is reduced, so low applied voltage can generate the stroke needed and the variation of the current hardly effect to the variation of the stroke. Therefore, stable load characteristic is maintained because the stroke variation is low even if the load variation is generated.

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DRIVING CONTROLLING APPARATUS FOR RECIPROCATING COMPRESSOR

TECHNICAL FIELD

The present invention relates a driving controlling apparatus of a reciprocating compressor using resonance, and more particularly, to a driving controlling apparatus of a reciprocating compressor using resonance with high current counteracting characteristics by offsetting an inductance value of a coil wound inside a motor by employing a capacitor.

BACKGROUND ART

In general, in a reciprocating compressor, power supplied to a coil wound at a polyphase stator is switched off by using a switching device to thereby generate a rotational torque. In this respect, by sequentially varying an excitation state between a rotor and a stator, a forward rotational torque can be generated by a magnetic suction force.

If a specific excitation state is not varied, the rotor can be stopped at a certain position, and by controlling a phase of an input pulse signal applied to the switching device by taking a maximum inductance as a starting point, a reverse-rotational force can be generated

With such various driving control availability, the reciprocating compressor is adopted for use to electric products requiring a direction control of the motor.

Especially, the reciprocating compressor used for a refrigerator or

air-conditioner, a compression ratio can be varied by a voltage applied to the motor, and accordingly, a cooling force can be varied according to a user's intention.

The reciprocating motor will now be described in detail with reference to Figure 1.

Figure 1 is a block diagram showing the construction of a driving controlling apparatus of a general reciprocating compressor.

As shown in Figure 1, the general reciprocating compressor includes: a reciprocating compressing unit (L.COMP) for varying a stroke by piston's movement to control a cooling force by a voltage applied to an internal motor according to a stroke command value; a voltage detector 30 for detecting a voltage generated at the reciprocating compressing unit (L.COMP) as the stroke is increased by the applied voltage; a current detector 20 for detecting a current applied to the reciprocating compressing unit (L.COMP) as the stroke is increased by the applied voltage; a microcomputer 40 for calculating a stroke with the voltage and the current detected by the voltage detector 30 and the current detector 20, comparing the stroke with the stroke command value and outputting a corresponding switching control signal; and an electric circuit unit 10 for switching off an AC power with a triac according to the switching control signal of the microcomputer 40 to apply a voltage to the reciprocating compressing unit (L.COMP).

The operation of the conventional reciprocating motor constructed as described will now be explained.

First, in the reciprocating compressing unit (L.COMP), the piston is

moved by the voltage applied according to the stroke command value set by a user, and accordingly, a stroke is varied to control a cooling force.

Meanwhile, as the turn-on period of the triac (Tr1) of the electric circuit unit 10 is lengthened by the switching control signal of the microcomputer 40, the stroke of the reciprocating compressing unit (L.COMP) is increased. At this time, the voltage and current applied to the motor (M) of the reciprocating compressing unit (L.COMP) are detected by the voltage detector 30 and the current detector 20 and applied to the microcomputer 40.

Then, the microcomputer 40 calculates a stroke by using the voltage and current detected by the voltage detector 30 and the current detector 20.

The stroke is compared with the stroke command value to output a corresponding switching control signal.

That is, if the calculated stroke is smaller than the stroke command value, the microcomputer 40 outputs a switching control signal for lengthening the ON period of the triac (Tr1) in order to increase the voltage applied to the reciprocating compressing unit (L.COMP).

If, however, the calculated stroke is greater than the stroke command value, the microcomputer 40 outputs a switching control signal for shortening the ON period of the triac (Tr1) to reduce the voltage applied to the reciprocating compressing unit (L.COMP).

The relation between the voltage applied to the motor (M) and the stroke can be expressed by the following equation (1)

$$V = L\frac{di}{dt} + R \cdot i + \alpha \cdot \bar{S} \text{ ------------- (1)}$$

wherein α indicates a motor constant for converting an electric force to a mechanic force, $\bar{S}$ indicates a stroke, 'R' is a internal resistance of the motor, and 'L' indicates an inductance of the motor (M) itself.

The inductance voltage $(L\frac{di}{dt})$ is almost similar to a back electromotive force $(\alpha \cdot \bar{S})$, and the voltage by the internal resistance (R) can be negligible compared with the back electromotive force $(\alpha \cdot \bar{S})$.

Accordingly, the voltage (V) applied to the motor (M) is determined by sum of the inductance voltage $(L\frac{di}{dt})$ and the back electromotive force $(\alpha \cdot \bar{S})$, and in order to generate a required stroke, the voltage (V) applied to the motor should be increased.

At this time, in order to improve an efficiency of the reciprocating compressor, the inductance (L) value of the coil wound on the motor (M) itself should be small, and the inductance (L) value of the coil becomes small as the size of the motor (magnet) is increased.

Thus, in order to improve the efficiency of the reciprocating motor, if the size of the mover (the thickness of the magnet) is increased, an air gap is increased, causing a problem that the overall size and cost of the reciprocating compressor is increased.

Meanwhile, if the size of the mover (the thickness of the magnet) is reduced, the inductance (L) value of the coil wound at the motor (M) is increased. Then, the current according to the voltage value for the stroke control of the reciprocating compressor would slowly work, so that the stroke

is not smoothly controlled.

TECHNICAL GIST OF THE PESENT INVENTION

Therefore, an object of the present invention is to provide a driving controlling apparatus of a reciprocating compressor which has an excellent current counteracting capacity by offsetting a quality which slows current operation characteristics as an inductance value of a coil wound inside a motor is increased by employing a capacitor.

DETAILED DESCRIPTION OF THE INVENTION

In order to achieve the above objects, there is provided a driving controlling apparatus of a reciprocating compressor having a reciprocating compressing unit controlling a cooling force by varying a stroke according to a piston's movement by a voltage applied to an internal motor according to a stroke command value and an electric circuit unit for switching an AC power with a triac and applying it to the motor of the reciprocating compressing unit, wherein the electric circuit unit includes a capacitor for offsetting an inductance of a coil wound at a motor itself of the reciprocating compressing unit.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram showing the construction of a driving controlling apparatus of a conventional reciprocating compressor; and

Figure 2 is a block diagram showing the construction of a driving

controlling apparatus of a reciprocating compressor using a resonance according to the present invnetion.

MODE FOR CARRYING OUT THE PREFERRED EMBODIMENTS

The operation and effect of a driving controlling apparatus of a reciprocating compressor will now be described in detail with reference to the accompanying drawings.

Figure 2 is a block diagram showing the construction of a driving controlling apparatus of a reciprocating compressor using a resonance according to the present invnetion.

As shown in Figure 2, a driving controlling apparatus of a reciprocating compressor includes: a reciprocating compressing unit (L.COMP) for varying a stroke by piston's movement to control a cooling force by a voltage applied to an internal motor according to a stroke command value; a voltage detector 30 for detecting a voltage generated at the reciprocating compressing unit (L.COMP) as the stroke is increased by the applied voltage; a current detector 20 for detecting a current applied to the reciprocating compressing unit (L.COMP) as the stroke is increased by the applied voltage; a microcomputer 40 for calculating a stroke with the voltage and the current detected by the voltage detector 30 and the current detector 20, comparing the stroke with the stroke command value and outputting a corresponding switching control signal; and an electric circuit unit 10 having a capacitor (C) to offset an inductance of a coil (L) wound at the motor (M) itself of the reciprocating compressing unit (L.COMP) and switching off an AC power with a triac

according to the switching control signal of the microcomputer 40 to apply a voltage to the reciprocating compressing unit (L.COMP).

The operation of the driving controlling apparatus of a reciprocating compressor will now be described in detail.

First, the piston is moved by an applied voltage according to a stroke command value set by a user, and accordingly, a stroke is varied to control a cooling force.

Meanwhile, as the turn-on period of the triac (Tr1) of the electric circuit unit 10 is lengthened by the switching control signal of the microcomputer 40, the stroke of the reciprocating compressing unit (L.COMP) is increased. At this time, the voltage and current applied to the motor (M) of the reciprocating compressing unit (L.COMP) are detected by the voltage detector 30 and the current detector 20 and applied to the microcomputer 40.

Then, the microcomputer 40 calculates a stroke by using the voltage and current detected by the voltage detector 30 and the current detector 20.

The stroke is compared with the stroke command value to output a corresponding switching control signal.

In this respect, in the present invention, the capacitor (C) is connected in series to the motor (M) to offset an inductance (L) of a coil wound at the motor (M), which will now be described in detail.

First, a voltage (V) applied to both ends of the motor (M) and the capacitor (C) can be deduced to the following equation (2):

$$V = L\frac{di}{dt} + \frac{1}{C}\int idt + R \cdot i + \alpha \cdot \bar{S} \quad \text{------------------- (2)}$$

At this time, a capacitance can be set by the following equation (3):

$$C = \frac{1}{(2\pi f)^2 L} \quad \text{---------------- (3)}$$

At this time, the capacitance (C) and the inductance (L) are previously set with values causing a resonance.

Accordingly, since the capacitance (C) and the inductance (L) are mutually resonated and offset, so that the voltage (V) applied to both ends of the motor (M) and the capacitor is deduced to the following equation (4):

$$V = R \cdot i + \alpha \cdot \bar{S} \quad \text{---------------------- (4)}$$

In equation (4), the applied voltage (V) has the similar size to the back electromotive force $(\alpha \cdot \bar{S})$ as the inductance voltage $(L\frac{di}{dt})$ is offset by the capacitor voltage $(\frac{1}{C}\int idt)$, and accordingly, a required stroke is generated at the low applied voltage (V).

In addition, since the voltage filled in the capacitor (C) is applied to the motor (M) like the applied voltage (V), a big stroke is generated with the small applied voltage. Thus, an overload counteracting capacity is improved

<u>**INDUSTRIAL APPLICABILITY**</u>

As so far described, according to the driving controlling apparatus of

a reciprocating compressor, since the current operation characteristics according to the increase in the inductance of the coil inside the motor is offset by employing the capacitor, the load of the applied voltage to inductance is reduced, and thus, a required stroke can be generated with the low applied voltage.

In addition, since the current change makes a little influence on the stroke variation, even though a load change occurs, the stroke variation is small, so that stable load characteristics are obtained.

CLAIMS

1. A driving controlling apparatus of a reciprocating compressor having a reciprocating compressing unit controlling a cooling force by varying a stroke according to a piston's movement by a voltage applied to an internal motor according to a stroke command value and an electric circuit unit for switching an AC power with a triac and applying it to the motor of the reciprocating compressing unit,

wherein the electric circuit unit includes a capacitor for offsetting an inductance of a coil wound at a motor itself of the reciprocating compressing unit.

2. The apparatus of claim 1, wherein the capacitor is positioned between the motor and a power supply unit.

3. The apparatus of claim 1, wherein the capacitor is positioned between the motor an the triac.

FIG. 1

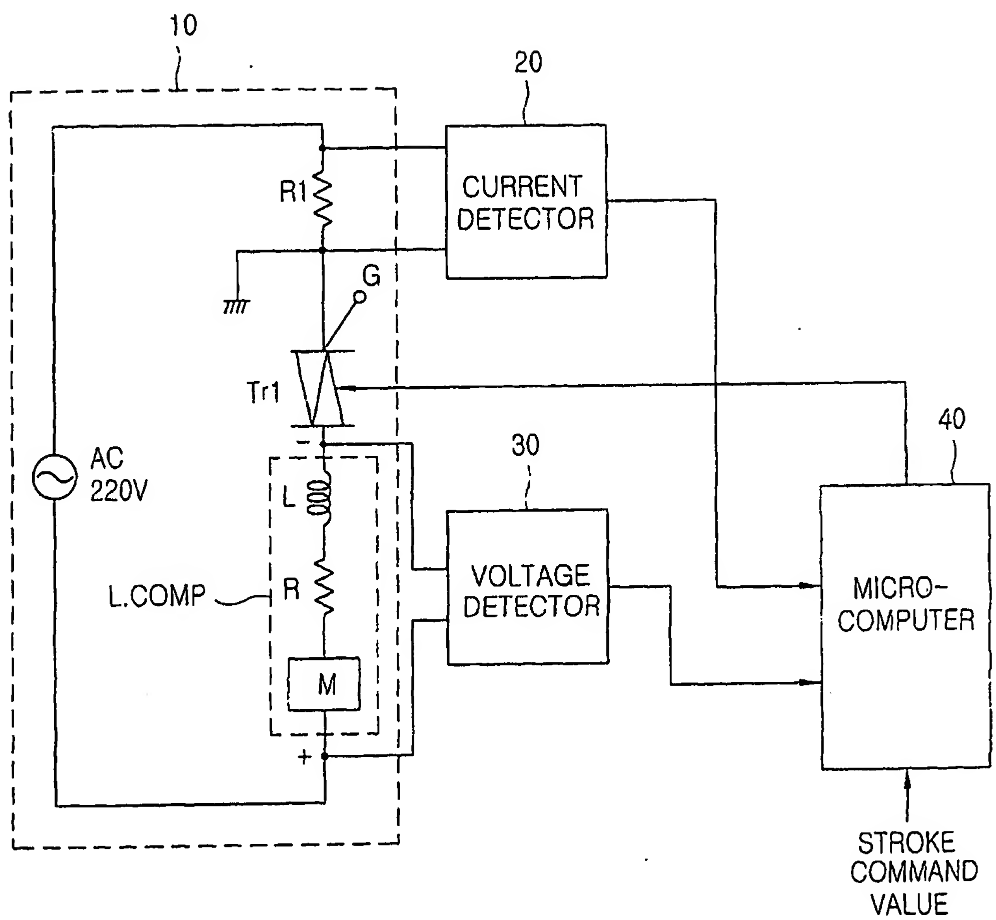
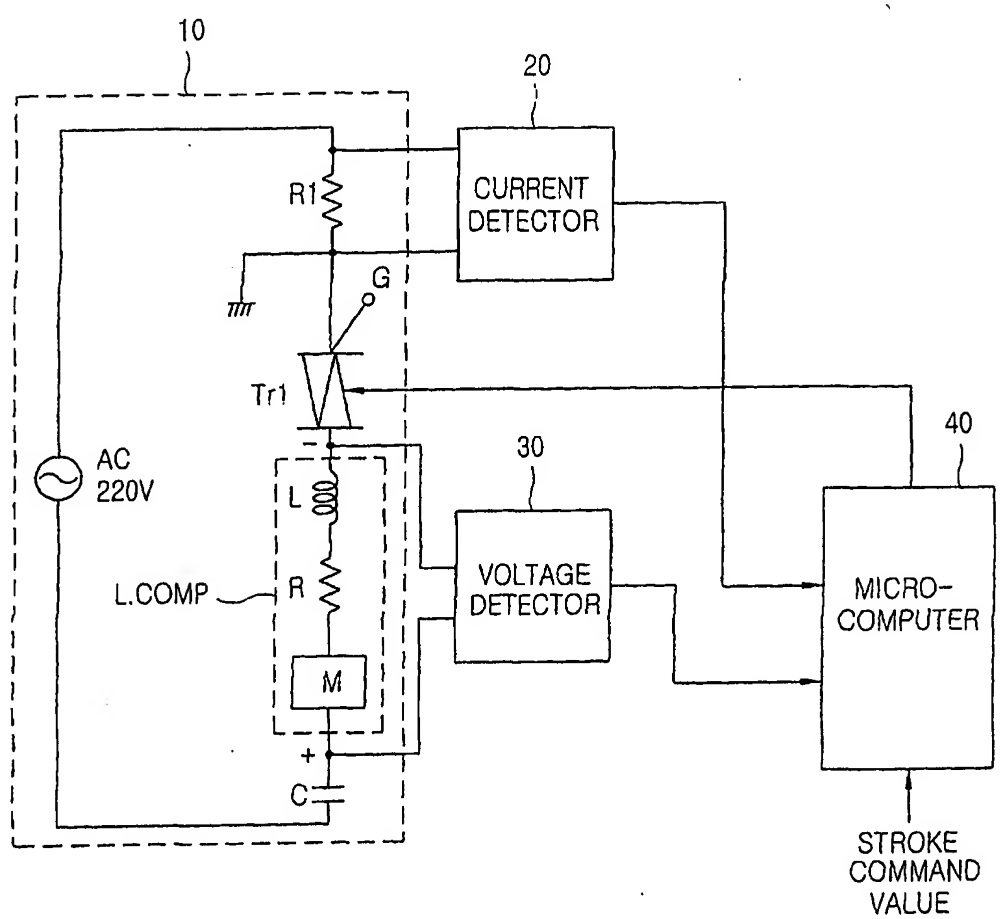

10
20
CURRENT DETECTOR
R1
G
Tr1
AC 220V
L
L.COMP
R
M
30
VOLTAGE DETECTOR
40
MICRO-COMPUTER
STROKE COMMAND VALUE

FIG. 2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MICRO-COMPUTER
STROKE COMMAND VALUE

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC7 F04B 17/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)
IPC7 F04B 49/02, 49/06

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched
Korean Patents and applications for inventions since 1975

Electronic data base consulted during the interntational search (name of data base and, where practicable, search trerms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 2000-40146 A (LG ELECTRIC INC.) 5 July 2000 Claim 1, Figure 1-3	1 - 3
A	KR 2000-40149 A (LG ELECTRIC INC.) 5 July 2000 Claim 1-3, Figure 1-3	1 - 3
A	Patent of Abstracts of Japan JP 9-112439 A (SANYO ELECTRIC CO. LTD.) 2 May 1997 Constitution, Figure	1 - 3

☐ *Further documents are listed in the continuation of Box C.* ☐ See patent family annex.

* Special categories of cited documents:
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